

WE CLAIM:

1. An imager having a print head for arranging directly over a production path, **characterized in that** the print head vertically moves on an axis perpendicular to the plane of the production path for allowing the print head to be purged, cleaned, parked, or a combination thereof, while the print head remains directly over the production path.

2. An imager according to claim 1, **characterized in that** the imager includes a mechanical coupling having a motor, a gear assembly and a vertical drive screw for vertically moving the print head.

3. An imager according to claim 2, **characterized in that** the imager includes a cartridge assembly having the motor and the gear assembly arranged therein, and the imager includes a service station assembly having the vertical drive screw attached thereto.

4. An imager according to claim 2, **characterized in that** the gear assembly has a vertical drive gear with inner threads for coupling to outer threads of the vertical drive screw.

5. An imager according to claim 4, **characterized in that** the gear assembly has a pinion gear coupled between the vertical drive gear and a shaft of the motor.

6. An imager according to claim 5, **characterized in that** the vertical drive gear and the pinion gear are arranged in a power transmission housing of the motor.

7. An imager according to claim 1, **characterized in that** the imager includes a service station assembly having an ink receptacle assembly that moves horizontally in relation to an axis parallel to the plane of the production path for purging, cleaning or parking the print head, or a combination thereof, while the print head remains directly over the production path.

8. An imager according to claim 7, **characterized in that** the imager includes a mechanical coupling having a motor, a first gear assembly, a square drive shaft, a second gear assembly and a receptacle drive shaft for horizontally moving the ink receptacle assembly.

9. An imager according to claim 8, **characterized in that** the imager includes a cartridge assembly having the motor and the first gear assembly arranged therein, and the service station assembly includes the square drive shaft, the second gear assembly and the receptacle drive shaft arranged therein.

10. An imager according to claim 8, **characterized in that** the first gear assembly has a square drive gear for coupling to the square drive shaft.

11. An imager according to claim 10, **characterized in that** the first gear assembly also has a pinion gear for coupling between the square drive gear and a shaft of the motor.

12. An imager according to claim 11, **characterized in that** the square drive gear and the pinion gear are arranged in a power transmission housing of the motor.

13. An imager according to claim 8, **characterized in that** the second gear assembly has two helical right gears coupled together, a first helical right gear connects to the square drive shaft, and a second helical right gear connects to the receptacle drive shaft.

14. An imager according to claim 7, **characterized in that** the ink receptacle assembly is slidably arranged in the service station assembly.

15. An imager according to claim 7, **characterized in that** the ink receptacle assembly includes a receptacle cover having either one or more pen cap seals for sealing one or more print heads, or one or more wipers for wiping the ink off the one or more print heads, or a combination thereof.

16. An imager according to claim 7, **characterized in that** the imager includes a cleaning station control circuit assembly for vertically and horizontally moving the print head.

17. An imager according to claim 16, **characterized in that** the cleaning station control circuit assembly includes a cleaning station processor, a motor control interface, a vertical motor, a horizontal motor, a vertical motor encoder and a horizontal encoder.

18. An imager according to claim 16, **characterized in that** the cleaning station control circuit assembly also includes a vertical home sensor, a horizontal home sensor and a paper sensor trigger.

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19. An imager according to claim 18, **characterized in**  
**that** the cleaning station control circuit assembly also  
includes an interface processor coupled to the cleaning  
station processor for interfacing input and output  
5 information signals to and from the cleaning station control  
circuit assembly.

20. A method for servicing a print head of an imager  
arranged directly over a production path, **characterized in**  
**that** the method includes vertically moving the print head on  
10 an axis perpendicular to the plane of the production path  
for allowing the print head to be purged, cleaned, parked,  
or a combination thereof, while the print head remains  
directly over the production path.

21. A method according to claim 20, **characterized in**  
15 **that** the step of vertically moving includes mechanically  
coupling a motor to the print head with a gear assembly and  
a vertical drive screw.

22. A method according to claim 21, **characterized in**  
**that** the method includes the step of arranging the motor and  
20 the gear assembly in a cartridge assembly of the imager and  
attaching the vertical drive screw to a service station  
assembly of the imager.

23. A method according to claim 21, **characterized in that** the step of coupling includes coupling inner threads of a vertical drive gear of the gear assembly to outer threads of the vertical drive screw.

5           24. A method according to claim 23, **characterized in that** the step of coupling includes coupling a pinion gear of the gear assembly between the vertical drive gear and a shaft of the motor.

10           25. A method according to claim 24, **characterized in that** the method includes the step of arranging the vertical drive gear and the pinion gear coupled thereto in a power transmission housing mounted inside the cartridge assembly of the imager.

15           26. A method according to claim 20, **characterized in that** the method includes horizontally moving a waste ink receptacle in relation to an axis parallel to the plane of the production path for purging, cleaning or parking the print head while the print head remains directly over the production path.

27. A method according to claim 26, **characterized in**  
**that** the step of horizontally moving includes coupling a  
motor to the waste ink receptacle with a first gear  
assembly, a square drive shaft, a second gear assembly and a  
5 receptacle drive shaft.

28. A method according to claim 27, **characterized in**  
**that** the method includes the step of arranging the motor and  
the first gear assembly in a cartridge assembly of the  
imager, and arranging the square drive shaft, the second  
10 gear assembly and the receptacle drive shaft in a service  
station assembly of the imager.

29. A method according to claim 27, **characterized in**  
**that** the step of coupling includes coupling a square drive  
gear of the first gear assembly to the square drive shaft.

15 30. A method according to claim 29, **characterized in**  
**that** the step of coupling includes coupling a pinion gear of  
the first gear assembly to a shaft of the motor.

31. A method according to claim 30, **characterized in**  
**that** the method includes a step of arranging the square  
20 drive gear and the pinion gear in a power transmission  
housing of the motor.

32. A method according to claim 27, **characterized in**  
**that** the step of coupling includes using two helical right  
gears in the second gear assembly, connecting a first  
helical right gear of the second gear assembly to the square  
5 drive shaft, and connecting a second helical right gear of  
the second gear assembly to the receptacle drive shaft.

33. A method according to claim 26, **characterized in**  
**that** the step of horizontally moving includes slidably  
arranging the ink receptacle assembly in the service station  
10 assembly.

34. A method according to claim 33, **characterized in**  
**that** the ink receptacle assembly includes a receptacle cover  
having one or more pen cap seals for sealing one or more  
print heads and one or more wipers for wiping the ink off  
15 the one or more print heads.

35. A method according to claim 26, **characterized in**  
**that** the method comprises servicing command steps including  
print command steps, park command steps, clean command steps  
and remove tray command steps.



36. A method according to claim 35, **characterized in that** the print command steps include:

receiving a print command;

extending the ink receptacle assembly to a tray print  
5 position; and

lowering the print head to a print position.

37. A method according to claim 36, **characterized in that** the print command steps also include:

checking if the print head is in a park position; and  
10 spitting the print head if the print head is in the  
park position;

38. A method according to claim 37, **characterized in that** the print command steps also include:

checking a vertical home sensor and moving the print  
15 head to a vertical home position if the print head is not in  
the vertical home position; and

checking a horizontal home sensor and moving the ink  
receptacle assembly to a horizontal home position if the  
print head is not in the horizontal home position.

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39. A method according to claim 35, **characterized in that** the park command steps include:

receiving a park command;

lowering the print head to a spit position;

5       spitting the print head; and

lowering the print head to a cap position.

40. A method according to claim 39, **characterized in that** the park command steps include two checking steps after the park command is received, including:

10       checking a vertical home sensor and moving the print head to a vertical home position if the print head is not in the vertical home position; and

15       checking a horizontal home sensor and moving the ink receptacle assembly to a horizontal home position if the print head is not in the horizontal home position.

41. A method according to claim 39, **characterized in that** the park command steps include moving the print head to the vertical home position after the step of spitting.

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42. A method according to claim 35, **characterized in that** the clean command steps include:

- receiving a clean command;
- lowering the print head to a spit position;
- 5       spitting the print head;
- lowering the print head to a wick position;
- extending the ink receptacle assembly to a tray wipe position;
- lowering the print head to a wipe position; and
- 10       move the ink receptacle assembly to a home position.

43. A method according to claim 42, **characterized in that** the clean command steps include two checking steps after the clean command is received, including:

- checking a vertical home sensor and moving the print
- 15       head to a vertical home position if the print head is not in the vertical home position; and
- checking a horizontal home sensor and moving the ink receptacle assembly to a horizontal home position if the print head is not in the horizontal home position.

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44. A method according to claim 42, **characterized in that** the clean command steps also include:

lowering the imager below a home sensor;

moving the print head to a vertical home position; and

5 moving the print head to a cap position.

45. A method according to claim 35, **characterized in that** the remove tray command steps include:

receiving a remove tray command; and

10 extending the ink receptacle assembly to a remove tray position.

46. A method according to claim 45, **characterized in that** the remove tray command steps include two checking steps after the remove tray command is received, including:

15 checking a vertical home sensor and moving the print head to a vertical home position if the print head is not in the vertical home position; and

checking a horizontal home sensor and moving the ink receptacle assembly to a horizontal home position if the print head is not in the horizontal home position.

47. An imager for arranging directly over a production path, comprising:

5 a cartridge assembly having a print cartridge with a print head that vertically moves on an axis perpendicular to the plane of the production path for allowing the print head to be purged, cleaned, parked, or a combination thereof, while the print head remains directly over the production path; and

10 a service station assembly having a waste ink receptacle that horizontally moves in relation to an axis parallel to the plane of the production path for purging, cleaning or parking the print head, or a combination thereof, while the print head remains directly over the production path.

15 48. An imager according to claim 47, **characterized in that** the waste ink receptacle is a snap-in disposable assembly consisting of a reservoir for waste ink, soft rubber capping seals and soft rubber pen wipers.

20 49. An imager according to claim 48, wherein the reservoir contains porous foam for absorption and dispersion of waste ink.

50. An imager according to claim 47, wherein the waste ink receptacle assembly slides within an imager base by way of software commanded motors, the service station assembly performing functions of pen wiping and cleaning, proper  
5 nozzle firing verification and capping of pens when not in use.

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51. An imager according to claim 50, wherein the cartridge assembly includes a cartridge lift motor for lifting the cartridge assembly a precise distance at pre-determined intervals or upon command in relation to the  
10 service station assembly.

52. An imager according to claim 51, wherein the cartridge assembly includes a wiper/ink receptacle driver motor for driving the waste ink receptacle under a nose of  
15 the print head thereby wiping one or more pen nozzles to remove excess ink residue.

53. An imager according to claim 52, wherein the wiper/ink receptacle driver motor retracts the waste ink receptacle to allow resumed printing, or the cartridge  
20 assembly lift motor lowers the cartridge assembly to allow the soft rubber capping seals to cap pens to prevent drying of the one or more pen nozzles until next use.

~~54.~~ An imager according to claim 1, **characterized in**  
**that** the production path has a conveyor belt having products  
to be printed moving thereon and underneath the print head.

~~55.~~ <sup>103</sup> An imager according to claim 1, **characterized in**  
5 **that** the production path is a continuous web to be printed  
moving underneath the print head.

56. A method according to claim 42, **characterized in**  
**that** the steps of the method are programmed to be performed  
automatically at periodic intervals.